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## ABSTRACT

In assessing the validity of Clark's (1983) argument that media have no real effect on learning, the fourth of four symposium papers identifies five aspects of media which might affect learning: (1) the technology used; (2) the symbol systems employed; (3) the content conveyed; (4) the setting in which the media are encountered; and (5) the thoroughness of the design of the messages conveyed. Noting that Clark's argument deals only with the technology used for the delivery of instruction, the impact on learning of the other four aspects of media is examined, including relationships between technology and the other aspects of media. Evidence is presented that these aspects of media affect learning and are typically associated with a medium's technology, but it is pointed out that these relationships are correlational rather than causal and do not mean that the technology has an effect on learning. It is concluded that higher-order principles rather than techniques with limited validity need to be studied to account for how people learn. A list of 16 references is included. (MES)

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Are Media Merely Vehicles for Instruction?

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### Media Research

Clark's (1983) statement that media have no real effect on learning has raised a number of issues that have proven to be quite controversial amongst both the scholars and the practitioners within the Educational Technology field. The purpose of this short paper is to assess the validity of Clark's claim from a number of perspectives. In so doing, it seeks to remind readers of the context in which Clark's comments were made and of the fact that his criticism was aimed at one particular aspect of media, namely their delivery role, and not at others, such as their efficiency.

People need to remember that Clark's paper is first and foremost a criticism of media research. There are two related premises that underlie his criticism. The first is that confounding leaves open a variety of interpretations of the results of studies that purport to demonstrate the instructional superiority of media. The second is that once the sources of confounding are removed from experiments, all that is left to vary is the way in which the media deliver their messages. Clark claims that how instructional messages are delivered has absolutely no effect on learning -- his "mere vehicles" statement. If Clark had only made the first criticism, then he would not have been able to conclude that media do not make a difference in instruction, only that the studies addressing the issue have been poorly designed and interpreted. The argument that media do not make a difference arises from his second criticism, namely that all they do is deliver information. It is with this that most of this paper will be concerned.

Before moving on, however, it is necessary, for reasons that will become apparent at the conclusion of the paper, to mention the purpose of the type of research that Clark criticizes. A number of scholars have stressed that what the field needs is a good theoretical foundation which at present it does not have. For example, Stewart (1985) complains that Educational Technology is concerned with techniques (tricks of the trade) at the expense of theoretical principles that can guide practice more generally. Salomon (1979) has called these "explanatory principles" of how and why things work the way they do, as opposed to prescriptions which, as he points out, practitioners rarely use anyway. The orientation that research in our field should take is therefore towards the construction of valid and robust explanatory theories that provide a framework within which to generate hypotheses and develop instructional theory. The power of explanatory theory, as opposed to mere descriptions and certainly to techniques, lies in its affirmation of cause-and-effect relationships rather than just correlations among constructs. It is therefore created by testing truly experimental rather than correlational hypotheses. We shall return to this later.

### Five Aspects of Media

Salomon (1979) precedes his well-known discussion of symbol systems by identifying four aspects of media that might, potentially at least, affect how people learn from them. These are: the

technology they use, the symbol systems they employ, the content they convey, and the setting in which one encounters them. To these, it is useful to add a fifth: the thoroughness that goes into the design of the messages that they convey. This is a principle source of confounding identified by Clark, particularly in studies of the effectiveness of CAI (Clark, 1985a, 1985b).

Clark's criticism is aimed at those who test hypotheses concerning the relative impact on learning of the first of these five aspects of media, namely the technology they employ. The technology is simply responsible for the delivery of instruction to students. The technology is the "delivery van" of Clark's metaphor. His criticism does not extend to research into the other four aspects of media. Clark implies that it is only the technology that can be uniquely associated with each medium. The other aspects cut across several media.

This leaves us with some unanswered questions. The first is: Do the other aspects of media -- their symbol systems, the content they convey, the setting in which they are placed and the care with which they are designed -- affect learning? The second is: If any of these four is related to learning, then are a medium's symbol system, content, setting and design in any way dependent upon their delivery technology? If the answer to this last question is "yes", then, apparently, there is a relationship between delivery technology and learning, albeit an indirect one.

#### Evidence for Impact on Learning

Beginning with the first of these two questions, the answer with respect to all four aspects of media is "yes". Salomon has demonstrated empirically (1974; see also Bovy, 1983) and argues on theoretical grounds that symbol systems certainly affect how a person learns. Indeed, his research on Sesame Street when it was introduced into Israel goes so far to propose that a symbol system can mould the mental skills of young children. In my own work (Winn, 1986; Cochran et al., 1986) it has been found that varying the repleteness of the symbols representing elements in maps and diagrams affects the way in which students perform tasks requiring serial or parallel processing of the information.

That variations in content affect what people learn is self-evident. If a medium carries information about a football game people will learn something different than if it had conveyed information about raising goats.

The setting in which people interact with media also has an effect on how they learn from them. This is true for both the social setting and, in a narrower sense, for cognitive "setting". The former is illustrated by Salomon's (1977) finding that encouraging mothers to watch Sesame Street with their children resulted in improved posttest scores for some children. In general, one finds that media viewed in the home tend to be considered as entertainment, while media viewed in school or in the workplace tend to be considered instructional.

In the narrower sense, Salomon (1984) has observed that what might be referred to as a "cognitive setting" also affects what

people learn from media. For example, television is thought to be easier to learn from than print with the result that students will invest less mental effort in learning from it. The result is that students often learn less from media that they consider "easy". A similar finding has been reported by Clark (1980) for instructional methods that students prefer. However, as in the case of the co-observing mothers, these effects on learning are indirect. That is to say, for children from a low SES background, watching Sesame Street with their mothers increased first the enjoyment of the program which in turn improved their posttest scores. Believing that television is easier means that students will not try as hard to learn from it as, say, from text. This in turn means that they will learn less.

Like the impact of content on what people learn from media, that the carefulness with which the instruction they carry is designed has an impact on what students learn is obvious. Evidence for this is abundant, and Clark (1985a) cites much of it in his meta-analysis of CAI research. Yet one hardly needs evidence from studies to convince one that instruction designed and especially field-tested to meet minimal instructional criteria, as just about every design model requires (Dick and Carey, 1985; Gagne and Briggs, 1979; Romiszowski, 1981, and many others), should be more successful than instruction that is not. One could even argue that superior effectiveness is de facto a characteristic of instruction that has been field-tested to a given criterion. (That does not mean that its other aspects, such as its flexibility, are superior. But that is another story). However, such a claim is still in need of empirical verification (Gerlach, 1984).

There is evidence, then, that although delivery technologies may not have an impact on what and how students learn from media, the symbol systems a medium employs, its content, the setting in which it is encountered, and the thoroughness with which the instruction it carries is designed all influence learning. There are two ways in which this evidence is typically interpreted. The first is to affirm, as the advocates of media do, that, because these are all aspects of media, media therefore influence learning. The second interpretation is to argue that none of these four factors is uniquely associated with a single medium, and that therefore they should be considered as sources of confounding and controlled for in media studies. The way to resolve this apparent contradiction is to look for evidence of relationships between technologies and the other four aspect of media. If such relationships can be found, then the case of the media advocates is apparently strengthened.

#### Evidence for Relationships between Technology and Other Aspects of Media

Are delivery technologies in any way associated with symbol systems? Indeed they are. In fact, Salomon (1979) defines a medium in terms of its technology and its symbol system. He points out that a technology is a necessary (but not sufficient) condition for the emergence of a new symbol system. Photography could not exist without the camera, nor is it likely that a great many of the

special graphic effects we see every day on television would have developed without the optical, electronic and digital technologies that create them. Although a medium begins by borrowing the symbol systems of other media, as television did from film and radio, and computers did from workbooks, which means they are by no means unique, the characteristics of the technology eventually permit the emergence of new symbol systems that are uniquely associated with that technology.

Content types are also associated with particular media. Newspapers carry information and opinions about current events, while books do not. Television carries commercials while film does not. Slides carry information about the way things look while printed texts tend to be more discursive. This is not to say that a particular medium is not capable of carrying all types of content. Rather it is the custom that it does not. The reasons are cultural and historical, not technical and psychological.

The same cultural and historical explanation is appropriate for the associations between technology and setting. The technology of film allows images of extremely high quality to be enlarged to the point where they can be viewed by hundreds of people at once. The relatively poor quality of enlarged television images precludes their viewing in such large groups effectively restricting television viewing to the home or classroom. Similarly, books are typically read silently by one person at a time. It is neither as effective nor as efficient to read them out loud to large groups. This does not mean that television cannot be shown in movie theaters nor that books cannot be read to large groups. It simply does not usually happen that way.

The technological aspect of media likewise is associated with how well the instruction they deliver is designed. The technology embodied in a computer permits a student to study alone, interactively, without the assistance of a teacher. However, to be successful such instruction must be meticulously planned and programmed. The designer must anticipate everything that is likely to occur once instruction has started that will affect how a student learns. When a teacher is involved, this is not the case. Instructional problems can be dealt with as they arise, which requires less thorough planning. The same is true of any mediated presentation that is intended to stand alone. Even mediated resources that are intended for use by a teacher require that pre- and post-presentation activities be planned. Again, this is not to say that CAI must be better planned than teacher-based instruction or that slide sets must be accompanied by prescribed activities. It is just the way it is usually done when it is done well.

Previously we established that a medium's symbol system, content, setting and design affect learning. We have now argued that symbol systems, content, setting and design are typically associated with a medium's technology. It seems logical to conclude that delivery technology must therefore affect learning as media advocates have claimed all along. But does this really follow? In the context of media research, which we must remember is what

Clark's paper was all about, it does not as we shall now see.

#### A Flawed Conclusion

The crucial step in the argument that media affect learning is the last one we examined -- the link between symbol systems, contents, setting and design with delivery technologies. The flaw in the conclusion that is typically drawn after presenting the sort of argument we did lies in the fact that symbol systems, contents, setting and design are correlates of a medium's technologies, nothing more. Thus, as we saw, television may use symbol systems that are as much aspects of other media as they are of it, and may not use the symbol systems it has helped to evolve. This is the case whenever a film is shown on television, whenever television shows a still picture or graphic, or whenever it shows a picture of a "talking head". A considerable percentage of the broadcast time of television is devoted precisely to these types of message. (It is perhaps ironic that it is in commercials that the greatest proportion of the unique symbol systems of television occur). We also saw that the contents of media and the settings in which they are usually encountered are more a result of custom than they are of anything else. In theory, any medium can convey any contents and can be used in any setting. Thus, films can carry news stories (remember the Pathe newsreels?), films can be shown in the living room, as home movies usually are, computers can show "slides", newspapers can serialize novels, and so on. Also, we saw that the messages delivered by technologies that permit students to study alone do not have to be better planned than those delivered by teachers. They just usually are. These examples may not account for the majority of times that a medium is used, but they are certainly the case a significant number of times.

The implication of this, of course, is that the relationships between delivery technologies and symbol systems, setting and design are correlational rather than causal, descriptive rather than explanatory. Researchers have observed that these relationships exist, but have not established any causality within them. By implication, the same applies to the relationship that might exist between delivery technology and learning. Because a researcher observes that students studying from a computer perform better than students studying from a workbook does not mean that the computer causes them to learn better. Moreover, the researcher's observation does not even explain why this appears to be the case. It simply records that it happened.

#### Research and Practice

We have in a sense come full circle. We began with the idea that the role of research in our area should be first to develop explanatory theory. Any discipline that thinks it can survive on rules of thumb is doomed to fail, and we have come pretty close to failure, for this reason, in Educational Technology. In our field, we like to insist that we bridge the gap between research and its application, between theory and practice, better than most educators. However, we have failed to accomplish this. The reason is that our research agendas have sought the short-term payoff at

the expense of long-term theory-building. It has been more profitable, in terms of our apparent prestige and even our pocketbooks, to find solutions to instructional problems that work for the moment. This "quick fix", "instant remedy" attitude pervades every aspect of our culture from cold remedies to social programs to foreign policy. But it is a dangerous attitude indeed in a science. So while it might be convenient, for the moment, to kid ourselves that media make a difference, and that we know how to select the right medium for the given objective, we must face up to the fact that we usually cannot explain why it is we make the recommendations we do. Fortunately few people have asked us to.

However, we have been caught out on many occasions. For example, we touted instructional television for a number of years. It worked, up to a point. But when it failed to live up to its expectations, we could only explain why in terms that avoided the real issues -- teachers refused to use it; it cost too much; people did not put enough money into producing quality programs. These read like excuses rather than explanations. If we had really understood that it was not television per se that was involved in any apparent improvements, but other "confounding" factors, we would have directed our attention not at the medium of television but at the instructional methods that users of television might employ with students, the settings in which instruction takes place, the cognitive processes it engages through its use of symbols, and so on.

A more current example concerns computers. Researchers have observed that CAI appears to improve student performance under a number of circumstances. As Clark (1985) has pointed out, the reasons we have given for this phenomenon have been faulty. But, we tell ourselves, it does not matter that the reason for the apparent superiority of CAI is, for instance, a Hawthorne effect and nothing intrinsic to the computer. Indeed, there is nothing wrong with designers exploiting the Hawthorne effect if it leads to better performance. However, what happens when computers are no longer a novelty, they no longer appear to provide superior instruction, and we cannot explain why? Our reputation suffers another setback and computers lose favor, just as instructional television did, for the wrong reasons.

#### Conclusion

At the root of many of the great tragedies in our literary tradition, from Sophocles to Ibsen, lies the lack of awareness of the tragic hero of what is going on around him. In that tradition things that one could not explain were attributed to Fate or to God. We, however, profess a different tradition, a "scientific" one that is based upon knowledge. The root of that tradition is understanding of what occurs so that we can explain it to ourselves and to others. Yet, in spite of our avowed rationalism, we cannot but fail to note a fatalism in the way in which we conduct research and develop instruction. We promote a promising medium, design poor experiments to study it whose results, like the pronouncements of the Delphic oracle, can be interpreted in a number of ways, one of which always

supports our faith in the medium. We continue to this, without really being able to explain why we are getting the results we observe, until the medium begins to fail us. We then dump it having learned nothing, and begin the whole process over again with another medium.

This is indeed tragic. If we were to develop explanatory theories operating at the level of principles rather than developing techniques whose validity is limited, we would be far more successful. In this regard, Clark is absolutely right. The media have nothing to with accounting for how people learn. Higher-order principles, or "methods", do, and it is these that we need to discover, promulgate and understand.

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